FOREST PEST CONDITIONS IN WISCONSIN

ANNUAL REPORT 1976

DEPARTMENT OF NATURAL RESOURCES
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FOREST PEST CONDITIONS IN WISCONSIN ANNUAL REPORT - 1976

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DEPARTMENT OF NATURAL RESOURCES
Division of Resource Management
Bureau of Forestry

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PREFACE

Information for this report was contributed by Department forest pest management specialists, foresters and other field personnel. Field personnel in cooperating public agencies and forest industry also contributed to the content.

Our thanks to all of them, to the typists at the Madison Area and Southern District Headquarters, and to the final assembly crew at Pyare Square for bringing everything together into the final product.

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Department of Natural Resources
Forest Pest Control Personnel - January 1, 1978

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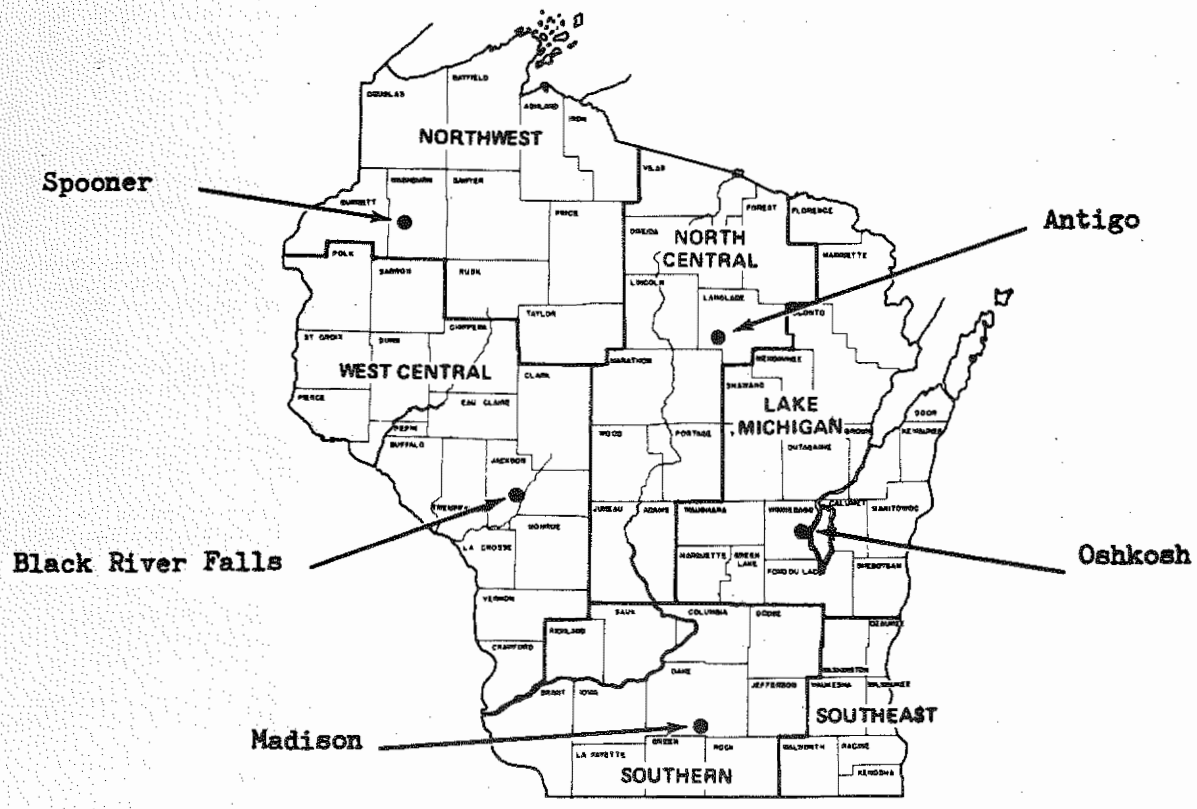


MAJOR FOREST INSECTS*

COLEOPTERA

Twolined Chestnut Borer - *Agrilus bilineatus* (Weber)
A September aerial survey revealed several pockets of mortality in the Baraboo hills, all east of U.S. 12 in Sauk and Columbia counties. Within most of the pockets, mortality ranged from 10 to 30 percent of the oak. Red, black, and white oaks were affected.

Two of the pockets were in areas that had been logged within the last two years; more than 50 percent of the residual oak was killed. The remainder of the mortality was related to one or two years of defoliation by the fall cankerworm. Ground inspection revealed that some pockets of 10 to 20 dead oaks surrounded one or two that were killed in 1975. An estimated 900,000 bd. ft. of merchantable oak were killed in the two county area.

The borer caused branch mortality in northern pin oak on southern exposures between Osseo and Hixton in Trempealeau and Jackson counties.

The borer was also associated with limb and tree mortality of red and northern pin oak in Menominee County (T30N, R16E) following severe defoliation in 1974 and 1975 by *Croesia semipurpurana* and *Archips argyrospilus*.

Pales Weevil - *Hylobius pales* (Herbst)
Reports of twig and branch mortality on red and white pine were received from Iowa and Trempealeau counties.

Pine Root Collar Weevil - *Hylobius radicis* Buchanan
Tree mortality continued in known infestations in Burnett and Washburn counties. An untended Scotch pine Christmas tree plantation (Sec. 11, T39N, R11W) continued to suffer considerable mortality. The situation was intensified by the presence, at least in low numbers, of the pine root weevil.

Scattered mortality occurred in Scotch pine Christmas tree plantings in the sandy soil along the Wisconsin River in Grant County.

Pine Root Tip Weevil - *Hylobius rhizophagus* Millers, Benjamin and Warner
Heavy branch and tree mortality occurred in red, jack and Scotch pine plantings on the dry sandy soils in southern Wood and northern Adams counties. Some root collar weevils were also present. Pure Scotch pine and overstocked jack pine plantings were especially hard hit.

A Christmas tree grower in Wood County complained about untended Scotch pine plantations which supported heavy weevil populations adjacent to his Christmas trees which were sustaining moderate branch mortality. He requested that the DNR act to prevent this type of nuisance from continuing. The Department advised the grower that a "zone of infestation" proceedings would not be appropriate because problem areas are localized and limited in distribution to certain sandy soil areas. It would be virtually impossible to establish that the weevils were threatening the forest resources of the state. The recommended course of action was to request that a local town ordinance be enacted designating untended Scotch pine plantings as a public nuisance.

Pine Engraver - *Ips pini* (Say)
Populations increased generally throughout the state due to the drought; northern counties, where the drought began in 1975, were particularly hard hit. The hot weather speeded insect development and three generations completed development over much of the state.

In the Northwest District, soil moisture was so low that the beetles were able to invade the moisture-stressed living trees in the spring. The second generation emerged to kill more trees in late summer. Most of the mortality was in small pockets near cutting or other cultural operations, or where road construction and other types of disturbance had provided suitable wood for beetle breeding.

In the North Central District, 20-30-year-old red pine plantations in need of initial thinning were frequently attacked in spots. In Lincoln County, 10 acres of pole sized red pine were killed near two pine pulpwood decks.

In the Southern District, several pole-sized red pine plantations and windbreaks had pockets attacked by the pine engraver after individual trees had been weakened by Diplodia canker and drought.

Pockets of declining 30-year-old planted red pines in Sauk County (Sec. 19, T8N, R4E) were killed by the pine engraver. No reason could be found for the decline in growth which began several years before the first trees died and which moved outward from a central area.

Hemlock Borer - *Melanophila fulvoguttata* (Harris)
Aerial surveys revealed a marked increase in hemlock mortality on Menominee Tribal lands (T30N, R15, 16E). Drought and root rot probably weakened the trees enough to allow successful invasion by the borer.

*Names conform with those found in: Common Names of Insects and Related Organisms (1978 Revision) published by the Entomological Society of America, Committee on Common Names of Insects, Douglas W. Sutherland, Chairman.

Northern Pine Weevil - *Pissodes approximatus* Hopkins
Damage was very light. A single report was received from Crawford County.

White Pine Weevil - *Pissodes strobi* (Peck)
Populations were very low throughout the state with only a few weevil-killed leaders noted.

DIPTERA

Balsam Gall Midge - *Paradiplosis tumifex* Gagné*
The light to moderate infestation continued on about five acres of natural balsam fir in Douglas County (Sec. 3, T43N, R13W). Only a few infested galls were found where a heavy infestation occurred in 1975 in a Christmas tree planting in Washburn County (Sec. 9, T42N, R13W). A heavy infestation was observed on scattered natural balsam in Washburn County (Sec. 27, T41N, R10W).

Severe infestations occurred in natural and planted balsam fir throughout Forest, Langlade, Lincoln, Oneida, and Marathon counties. The most severe damage occurred in eastern Langlade County where some plantings were heavily damaged and natural 30-foot trees were turning yellow by mid-September.

Control efforts by individual Christmas tree growers with malathion, granular disyston, and orthene wettable powder soil drench were unsuccessful. The severe drought probably had some effect on the soil applied chemical control attempts.

Sticky-trap catches of larvae in late September and October indicated high populations in 1977.

Experimental insecticide applications were conducted in cooperation with the University of Wisconsin, Department of Entomology. Results are reported in:

Benjamin, Daniel M. and S. E. Banash. 1976. Pyrethroid SD-43775 and Orthene + polymer No. H-800 P(D) for control of the balsam gall midge. Univ. Wis. For. Res. Note 199.

Phenological Notes:
May 20 - Peak of adult emergence in traps.
May 27 - Eggs have just hatched; some larvae completely covered by needle growth, others partially covered. Frazer fir buds starting to enlarge.

HOMOPTERA

Pine Spittlebug - *Aphrophora parallela* (Say)
Spittle masses on pines were generally common for the second year in the northern 2/3 of the

A heavy infestation was observed in Marathon County. Spittle masses 2 to 3 feet in length were observed the tops of pole sized white pine which were being released from overtopping aspen.

Two heavy populations were observed in Jackson County. A Christmas tree grower sprayed Scotch pine with malathion in Jackson County on June 8 when the insects were in the nymphal stage.

Saratoga Spittlebug - *Aphrophora saratogensis* (Fitch)
Several pockets of heavy flagging occurred on red pine plantings in Burnett County (Sec. 6, 7, T39N, R17W; Sec. 12, T39N, R18W; Sec. 18, 19, 20, 31, T40N, R17W; Sec. 36, T40N, R18W).

An evaluation survey of the nymphal stages conducted on state forests and Menominee Tribal forests revealed 100 acres of red pine plantings (Sec. 2, 3, T29N, R16E) that had sufficient flagging and high enough nymphal populations to require suppression. The Wisconsin Department of Natural Resources cooperated with the U.S. Forest Service - State and Private Forestry and the Bureau of Indian Affairs to conduct an aerial insecticide application. A Cessna Agwagon calibrated to deliver 10 fl. oz. Cythion (95% active malathion) per acre gave excellent control. For details see: Millers, I. and S. E. Banash. 1976. Biological evaluation of Saratoga spittlebug on the Menominee Indian Reservation. U.S. Forest Service Forest Insect and Disease Management Evaluation Report.

Balsam Twig Aphid - *Mindarus abietinus* Koch
High populations caused concern among growers of balsam fir Christmas trees in Langlade County. Most used a dilute solution of malathion to reduce twig damage. On natural balsam, the pest had disappeared by late June (NENE Sec. 28, T30N, R10E; NWSW Sec. 15, T32N, R12E).

A Cicada - *Okanagana rimosa* (Say)
Heavy populations of adults were active in June in the Northwest and North Central Districts ovipositing in a variety of hardwood species. Serious damage to hybrid aspen and yellow birch was observed in the forest genetics outplanting at the Oconto Seed Orchard

Phenological note:
June 17 - Adults mating and ovipositing in Menominee County.

*Formerly *Dasineura balsamicola* (Lintner). See Annals Entomological Society of America, Vol. 71, No. 1, January, 1978.

Pine Bark Adelgid - *Pineus strobi* (Hartig)
Reports of minor problems with this species were received from Crawford, Richland and Outagamie counties. In Sauk County a grove of 60-foot-tall white pines were treated with malathion. On the Southern Unit, Kettle Moraine State Forest in Walworth County (Sec. 10, T4N, R15E), several hundred white pine saplings died from a combination of drought, grass competition, and heavy populations of pine bark aphids. The land manager desired more openings in the plantation for aesthetic reasons; therefore, no action was taken.

Pine Tortoise Scale - *Toumeyella parvicornis* (Cockerell)
Occasional light infestations were noted in the West Central and Northwest Districts. Heavy infestations on individual jack pine were reported from Langlade and Vilas counties. A Scotch pine Christmas tree planting was damaged in Langlade County (Sec. 18, T33N, R11E).

HYMENOPTERA

Introduced Pine Sawfly - *Diprion similis* (Hartig)
Populations were greatly reduced over the entire state. No defoliation was noted and larvae were scarce.

Birch Leafminer - *Fenusa pusilla* (Lepeletier)
Populations generally increased in the northern counties. Noticeable to very heavy browning of white birch leaves was observed in Ashland, Price, Taylor, Langlade, Forest, Marathon, Chippewa, Lincoln, Sheboygan, Oneida and Shawano counties. The usual numbers of reports were received of damage to ornamental birch throughout the state.

Redheaded Pine Sawfly - *Neodiprion lecontei* (Fitch)
Populations were very low. Only a few scattered colonies were observed in the Northwest and North Central Districts.

Red Pine Sawfly - *Neodiprion nanulus nanulus* Schedl
Populations were very low. An infestation in pole-sized Scotch pine was reported in Columbia County.

White Pine Sawfly - *Neodiprion pinetum* (Norton)
Populations in Grant County were lower than in 1975. Three small infestations were reported.

European Pine Sawfly - *Neodiprion sertifer* (Geoffroy)
Populations in Dane, Rock, Racine, and Kenosha counties remained at about 1975 densities. A known infestation in Grant County nearly disappeared. New infestations were noted near Edgerton and Brodhead.

Two new infestations were observed on the Southern Unit - Kettle Moraine State Forest. In a 12 year old red pine planting (Sec. 10, T4N, R16E), egg clusters were readily found in October. Several open-grown trees had been moderately defoliated. Several sawflies were observed mating and ovipositing.

Larch Sawfly - *Pristiphora erichsonii* (Hartig)
Aerial and ground surveys revealed severe defoliation of most tamarack stands in Vilas, Oneida, Forest, Langlade, and Lincoln counties. Some small areas of moderate to severe tamarack defoliation were observed in Douglas, Ashland, Bayfield, Washburn and Sawyer counties.

Mountain-Ash Sawfly - *Pristiphora geniculata* (Hartig)
Many complaints were received of defoliation of ornamentals in Washburn, Sawyer, Marathon, Langlade and Lincoln counties.

LEPIDOPTERA

Pecan Leaf Casebearer - *Acrobasis juglandis* (LeBaron)
Populations were generally low with occasional moderate numbers in young plantings. In two black walnut plantations in Green (NWSE Sec. 5, T4N, R6E) and Dane (NENE Sec. 28, T8N, R7E) counties, populations were high through the larval stages but collapsed before autumn when few overwintering hibernacula could be found.

Fall Cankerworm - *Alsophila pometaria* (Harris)
The outbreak of *A. pometaria* continued but few spring cankerworms, *Paleacrita vernata* (Peck) or linden loopers, *Erannis tiliaria* (Harris) were observed.

Heavy defoliation was observed in Adams, Columbia, Juneau, LaCrosse, Sauk and Wood counties. Heavy defoliation occurred in the Van Loon Public Hunting Ground (LaCrosse County) for the second year. Spots of heavy defoliation occurred in the Baraboo Range and in Rocky Arbor State Park for the second year although severity was considerably reduced.

Numbers of the predator, *Calosoma calidum* (Fabricius) were extremely high in areas defoliated the second consecutive year.

Phenological Notes:
May 13 - Eggs have hatched in the southern half of the state.
May 19 - Larvae mostly in second instar in Sauk County.
June 9 - Larval development nearly complete in Sauk and Columbia counties.
June 11 - Larval development nearly complete in LaCrosse County.

Greenstriped Mapleworm - *Anisota rubicunda* Fabricius
Moths were common in the spring in parts of Washburn County but no defoliation was reported.

Oak Webworm - *Archips fervidanus* (Clemens)
Light populations continued in 1976. The largest numbers of webs were observed in Jackson County.

Large Aspen Tortrix - *Choristoneura conflictana* (Walker)
Populations were reduced from 1975 levels. No reports of defoliation were received.

Spruce Budworm - *Choristoneura fumiferana* (Clemens)
The infestation in northeastern Wisconsin continued to expand in size and severity. It now covers the spruce-fir type in eastern Oneida, eastern Vilas counties and all of Forest County. Light infestations were observed for the first time in northern Langlade and western Florence counties and for the second year in Lincoln and Oconto counties.

Populations were heavy enough to cause light to severe defoliation on about 104,000 acres of spruce and fir (Figure 1).

Egg mass counts, which had declined for two years, increased from .49 masses per 15-inch branch in 1975 to 1.20 in 1976, a 15-inch branch being one measured back from the end-bud and including needle-bearing laterals. Most of the increase was in areas of light to moderate defoliation in northern Forest County. Some of the increase may be due to the new plots that were established to adequately monitor the infestation. Egg parasitism remained about equal to the 1975 level with about 37% of the egg masses showing some evidence of parasitism.

Salvage cutting operations continued near Monico (Oneida County) and Argonne (Forest County) where spots of heavy balsam fir mortality continued to enlarge. Some dead material was not salvageable because it occurred in many small patches and on dry hummocks in the midst of wetlands.

Large scale chemical control operations are not feasible in the area because of the scattered pattern of balsam and spruce and the presence of open water and wetlands. The required barrier zones between the water and spray areas would preclude spraying a large proportion of the population which would perpetuate the infestation.

The present management policy is to map heavy defoliation, schedule salvage cutting in high mortality stands, and establish priorities for harvesting the more valuable stands with lesser amounts of mortality.

Phenological Notes:
May 25 - Larvae were 70% in the 2nd instar and 30% in the third. Balsam buds varied from tightly closed to one inch in length. On the trees with tight buds, 2nd instar larvae had spun light webs at the bases of buds.
June 8 - Larvae were primarily 5th and 6th instars in Vilas County.
June 22 - Larvae were 15% in the sixth instar and 85% in the pupal stage in Oneida County.
June 30 - No larvae found with 90% pupae and 10% adults in Forest County.

Jack Pine Budworm - *Choristoneura pinus* Freeman
Budworm populations were generally low in jack pine stands throughout the state. Only a few spots in Douglas County showed moderate defoliation (T43N, R13W, and T43N, R10W). The anticipated high early larval populations failed to materialize. Through March, overwintering larvae appeared normal and quite numerous. Weather in the 30^0 to 40^0 range was common in late March through April and early May. Overwintered larvae did not start emerging from hibernation to feed until mid May. Many of them failed to emerge apparently due to depletion of their stored energy reserve used during early intermittent periods of warmer-than-normal weather. Late larval counts were generally low. A few plots had high pupal counts, indicating excellent survival of larvae that were present. *Apanteles sp.* parasites caused a significant population reduction in some areas. Egg counts were extremely low with a majority of the plots showing none at all.

A few local spots of higher-than-usual numbers of larvae occurred in Jackson County but the population dropped and no serious defoliation occurred.

A larval survey covering most of the jack pine type in Vilas and Oneida counties yielded 2 larvae in 20 plots.

A small area of moderate defoliation was discovered in Menomonie County. It apparently collapsed as no egg masses were found on 10 plots. Because of the low populations, planned insecticide tests in Douglas County were cancelled.

Because of successful 1975 tests of the bacterial insecticide, Thuricide 16B, in Douglas County, this material is now registered for control of jack pine budworm.

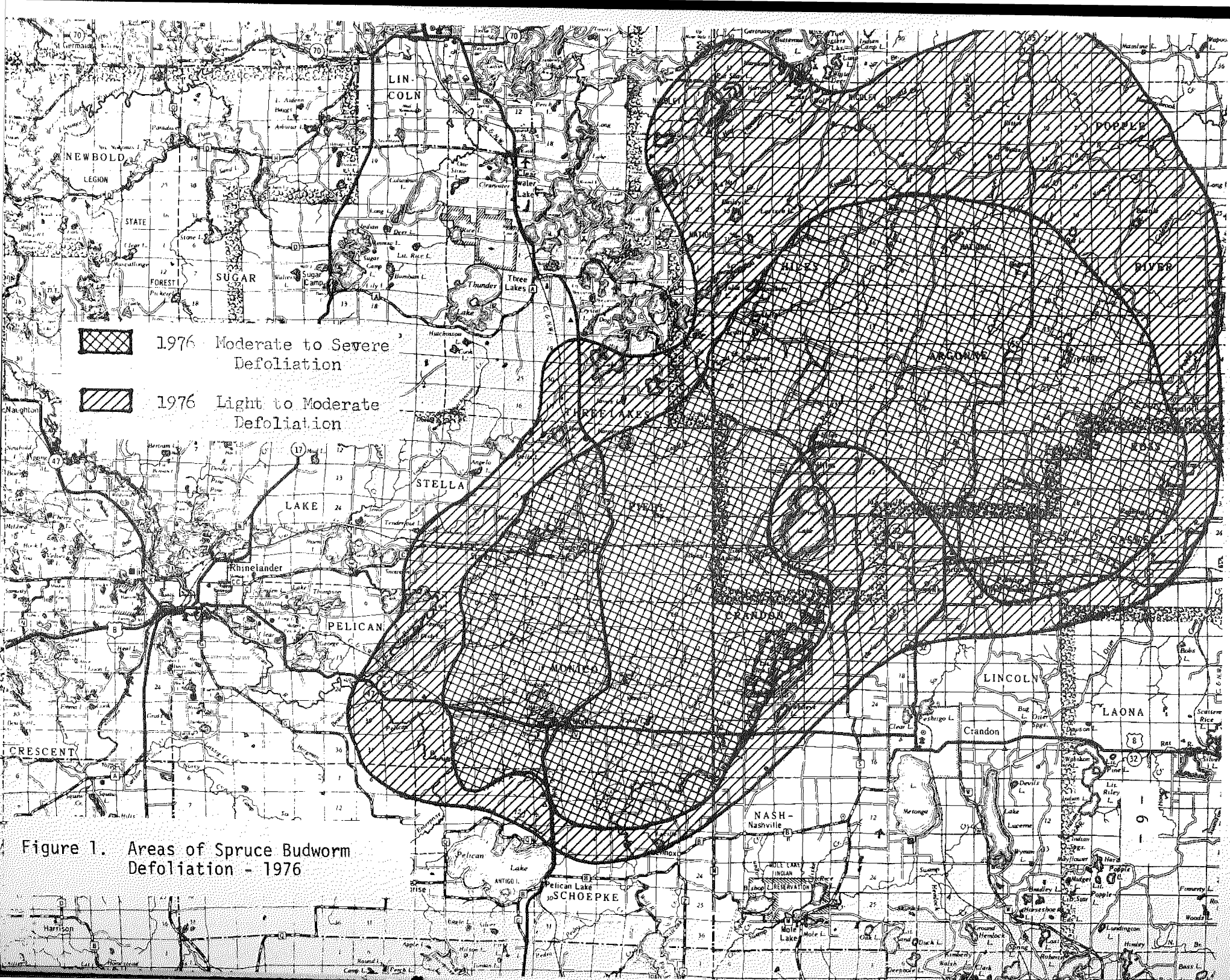


Figure 1. Areas of Spruce Budworm Defoliation - 1976

Phenological Notes:

May 14 - Larvae starting to break hibernation in Washburn and Douglas counties. Pollen cones large and yellow-green. Jack pine leaders 2" to 5" long. Oak flowers coming out.
May 17 - Larvae emerging in northern Douglas and southern Bayfield counties. No webbing or feeding evident. Pollen green and hard. Jack pine leaders 1" to 4" long. Oak buds breaking.
May 24 - Pollen ripe and gone in Washburn and southern Douglas counties. Larvae feeding but still 2nd instar. Jack pine leaders 2" to 6" long.
May 26 - Larvae still small 2nd instar. Jack pine leaders 3" to 10" long.
June 1 - Some 3rd instar larvae in Douglas County.
June 7 - Larvae in 2nd, 3rd and some 4th instars.
June 15 - Larvae 4th, 5th and 6th instars in Douglas County.
June 16 - Found first pupae in Douglas County.
June 28 - 80% pupated in Douglas County.
July 7 - 95% pupated. Found first adults.
July 23 - 90% in egg stage. Many already hatched.

Oak Leaftier - *Croesia semipurpurana* (Kearfott)
Populations in Menomonie County declined drastically. Only a single spot of light defoliation was observed northeast of Keshena.

Pine Tussock Moth - *Dasychira pinicola* (Dyar)*
Pine tussock moth larvae and eggs were found in several locations during the jack pine budworm survey, so a tussock moth egg survey was initiated. This revealed light infestations in the following areas:

Burnett County	T40N, R17W, Section 14
	T41N, R15W, Sections 2 and 3
Washburn County	T42N, R13W, Section 36
Douglas County	T43N, R13W, Sections 15, 21, 29 and 32
	T44N, R12W, Section 27

These areas will be monitored closely in 1977 to determine survival and possible increase in numbers.

Zimmerman Pine Moth - *Dioryctria zimmermani* (Grote)
Injury to shoot tips in red pine plantings was common in Waushara, Portage and Jackson counties. Moderate to heavy damage to red pine was reported in several state forest plantings in Jackson County (Sec. 35 and 36, T21N, R2W).

Pine Needleminer - *Exoteleia pinifoliella* (Chambers)
Pockets of needleminer activity were again noticeable in Washburn (T41 and 42N, R13W) and Douglas (T43N, R12 and 13W) counties. No other needle miner activity was reported.

Saddled Prominent - *Heterocampa guttivitta* (Walker)
Heavy defoliation of sugar maple and beech occurred in Door County on Detroit, Plum, Rock, and Washington islands and in Newport State Park and on the tip of the penninsula east of Gills Rock (Figure 2).

Overmature and mature timber were more severely defoliated. Beech and maple were hit hardest. Oak, basswood and open-growing beech were relatively free of the insects. Defoliation ranging from light to heavy covered an estimated 10,000 acres. Several infestations have occurred in the area since 1954.

Variable Oakleaf Caterpillar - *Heterocampa manteo* (Doubleday)
Populations were very low throughout the state. No defoliation was reported and few larvae were observed.

Fall Webworm - *Hyphantria cunea* (Drury)
Populations were very low even where the highest numbers of nests are normally found in the southwest counties.

Aspen Blotch Miner - *Phyllonorycter tremuloidiella* (Braun)
The heavy infestation continued in Oneida and Vilas counties.

Gypsy Moth - *Lymantria dispar* (Linnaeus)
About 5,800 pheromone baited traps were placed in Wisconsin by personnel of USDA-APHIS (PPQ), Wisconsin Department of Agriculture, and DNR. PPQ placed traps in a grid with about one trap per nine square miles (see map) more intensive trapping was done around the 1975 catches in Appleton, Manitowoc and Elkhart Lake. DNR and WDA personnel trapped public and private campgrounds, parks, rest areas and other strategic locations.

Ten male gypsy moths were caught in Appleton near the 1975 multiple catch. One male was caught on the east edge of Madison near the junction of I-90 and I-94.

Eastern Tent Caterpillar - *Malacosoma americanum* (Fabricius)
Populations generally increased in central and northern counties and decreased in the southern counties. Scattered tents were locally abundant on cherry and juneberry in Burnett, Douglas, and Washburn counties and on cherry and apple in Marathon and Langlade counties. Locally-moderate infestations were reported in Douglas, Jackson and Winnebago counties.

*Formerly *Dasychira plagiata* (Walker).

Phenological Notes:

April 13 - Eggs hatching in Dane County.
April 21 - A 2-inch diameter tent observed in Sauk County.
May 12 - Larvae in 2nd instar in Dane County; tents 4-6 inches in diameter. Development is locally more advanced on dry sandy soils with about 25% 2nd, 50% 3rd, and 25% 4th instar.
May 26 - Caterpillars 3/4 to one inch long in Douglas, Bayfield and Washburn counties.
May 19 - Some caterpillars in last instar in Rock and Walworth counties.
June 9 - Larvae pupating in Dane County.
June 25 - Adults collected in blacklight traps during past week at Lancaster (Grant County) and Mazomanie (Dane County).
June 30 - Egg masses beginning to appear in Rock County.

Forest Tent Caterpillar - *Malacosoma disstria* Hubner

Populations were generally slightly lower than in 1975. Scattered late instar larvae were occasionally reported over the northern half of the state. Two colonies were reported from widely separated locations in Bayfield County. Larvae were commonly observed on apple trees in the City of Antigo (Langlade County).

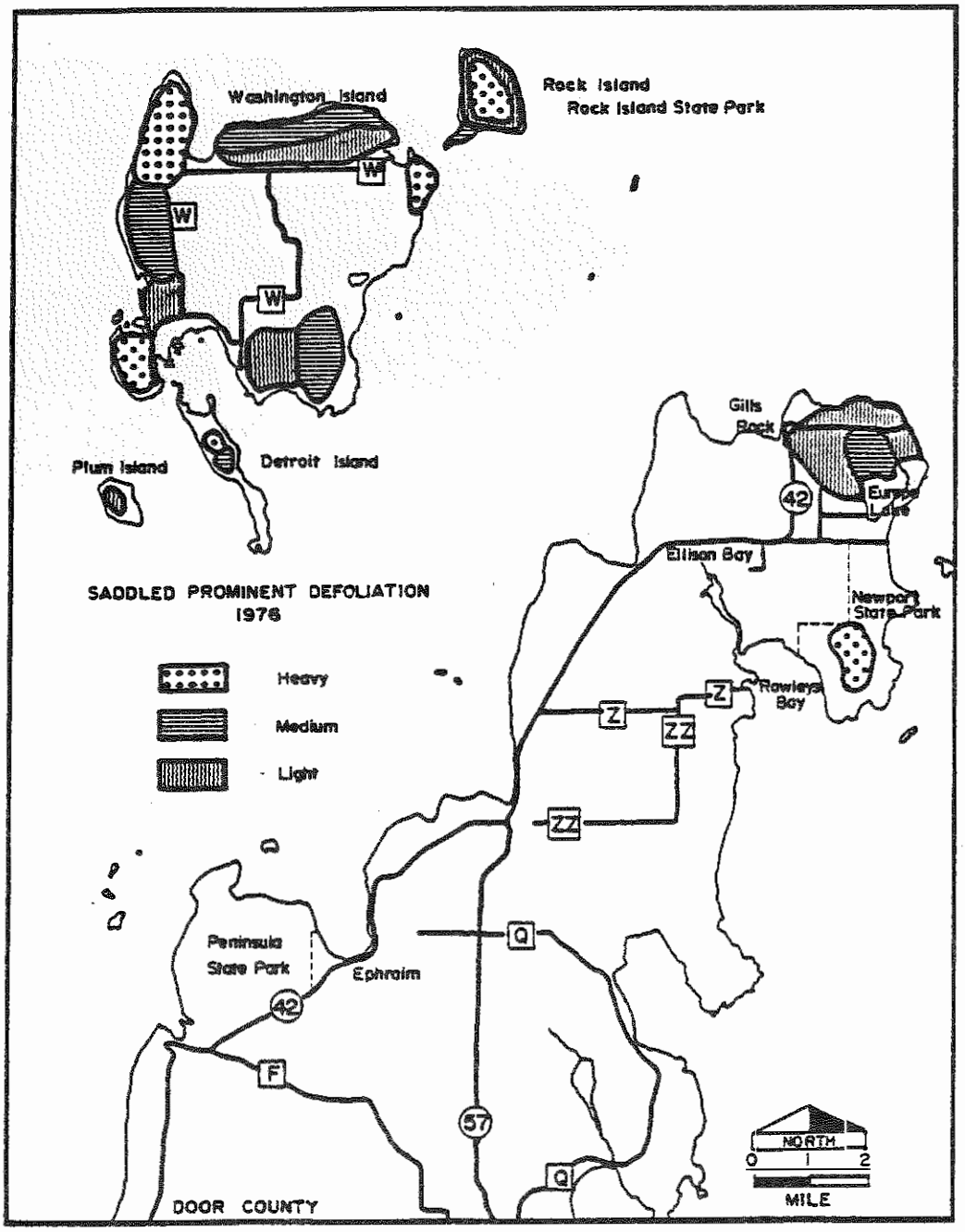


Figure 2. Saddled Prominent Defoliation - 1976.

WILTS AND DIEBACKS

Oak Wilt - *Ceratocystis fagacearum* (Bretz) Hunt

Established oak wilt pockets continued to enlarge and occasional new infection centers were observed in northern pin oak stands in central Wisconsin. There was also an increase in the number of bur oaks infected in the southern part of the state. The March, 1976 ice storm in southern Wisconsin did not appear to cause an increase in oak wilt this past summer. Oak mortality caused by the twolined chestnut borer in Sauk County caused some confusion for awhile because trees killed by the two agents produced similar symptoms. There was no change in state-wide distribution of oak wilt in 1976 (Figure 3).

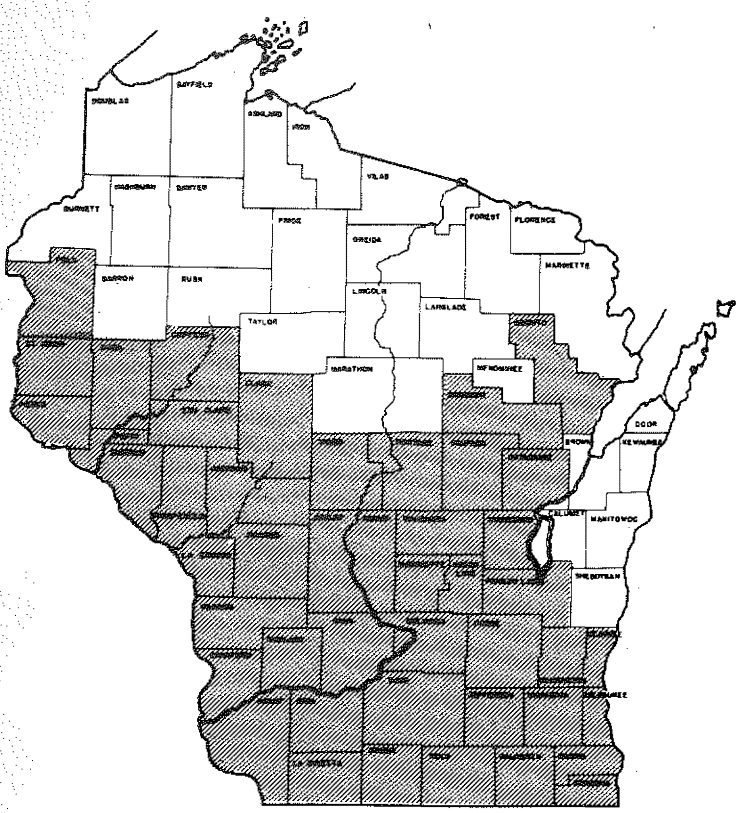


Figure 3. Known distribution of oak wilt in Wisconsin - 1976.

Dutch Elm Disease - *Ceratocystis ulmi* (Buisman) Moreau

Dutch elm disease continues to be the major forest disease problem in Wisconsin. Millions of board feet are dying and are not being utilized because of limited markets and unfeasibility of getting much of it to processing plants. The disease was first reported in 1956 in Wisconsin and has been found in every county in the state since 1975.

Dutch elm disease is the most serious problem in the hardwood forests of north central and northeastern Wisconsin. Based on aerial observations, the disease has become catastrophic with new infections and dead elm eliminating approximately 45% of the total elm trees surveyed. Unseasonably hot, dry conditions were ideal for rapid development of the disease as symptoms were peaked about the middle of June. Aerial mapping of the disease concentrations were completed for Menominee County in early July. Cutting compartments were manipulated to harvest the more valuable concentrations of elm. Timber harvest schedules will also have to be adjusted for an earlier cut on State Land Commission lands in Forest County. The disease increased in the big timber from a few scattered trees to 50% of the elm over a two-year period.

STEM AND BRANCH DISEASES

Diplodia Canker - *Diplodia pinea* (Desm.) Kickx

The fungus *Diplodia pinea* (Desm.) Kickx, is the cause of a relatively common tip blight that kills needles and shoots at the tips of living pine branches. Serious damage including tree mortality has occurred on numerous species of hard pines in several areas of the world. Recent outbreaks of this disease have been noted on several thousand acres of red pine, *Pinus resinosa* Ait., in windbreaks, nurseries, Christmas tree plantings, plantations and on ornamentals (Figure 4). Pitch-soaked girdling cankers are produced under the bark of affected trees killing individual branches, tops of trees, or entire trees. Recent drought conditions may have weakened some trees making them more susceptible to infection. Fruiting bodies are produced on cones, needles, shoots, branches, and tree boles. Spores can infect trees through wounds caused by such agents as hail, insects, and Christmas tree shearing.

A cooperative study of *Diplodia pinea* on pine was established with the USDA-Forest Service, North Central Forest Experiment Station. Information was gathered on spore dispersal, host phenology and weather data at sites on the Black River State Forest (on jack pine), Griffith Nursery, Wisconsin Rapids (on red pine) and at Hayward Nursery, Hayward, Wisconsin (on red pine). Spores were trapped on petrolatum coated microscopic slides that were changed weekly at all sites. *Diplodia pinea* spores were trapped on Black River State Forest and at Griffith Nursery but not at Hayward Nursery (Table 1). The results revealed that spores were discharged from May-October but only after several hours of rainfall (Figure 5). A few infected 3-0 red pine seedlings were found at Griffith Nursery in 1975 and 1976 and may have become infected from adjacent red pine windbreaks. Infected seedlings were culled before shipment to minimize the movement of the disease into newly established plantations.

At Brodhead, Wisconsin (Green County), pine cones were collected from four infected windbreaks and examined for the presence of *D. pinea* spores. *Diplodia pinea* was present on cones in all the windbreaks.

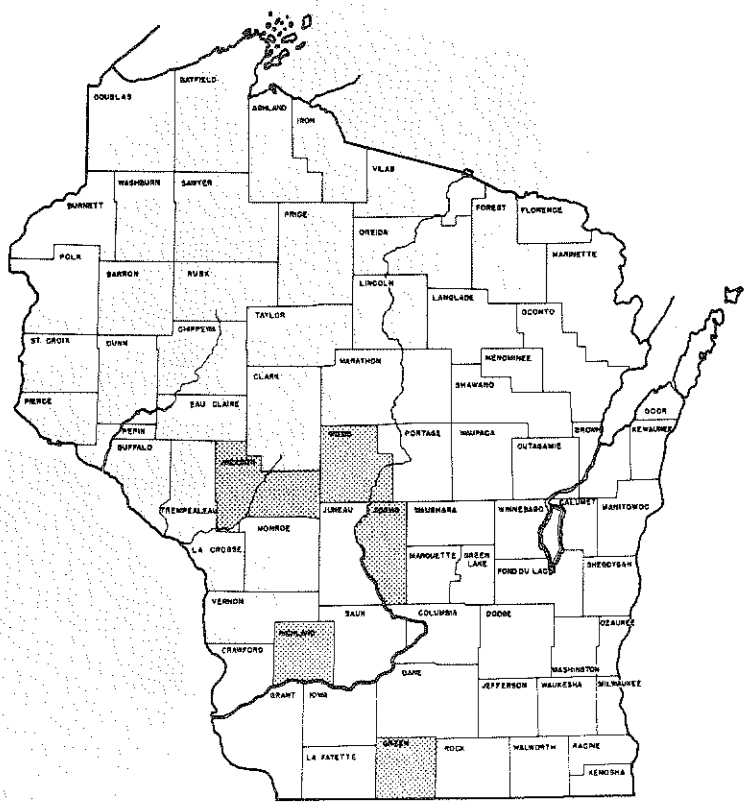


Figure 4. Counties where *Diplodia pinea* was epidemic on red pine or jack pine in 1976.

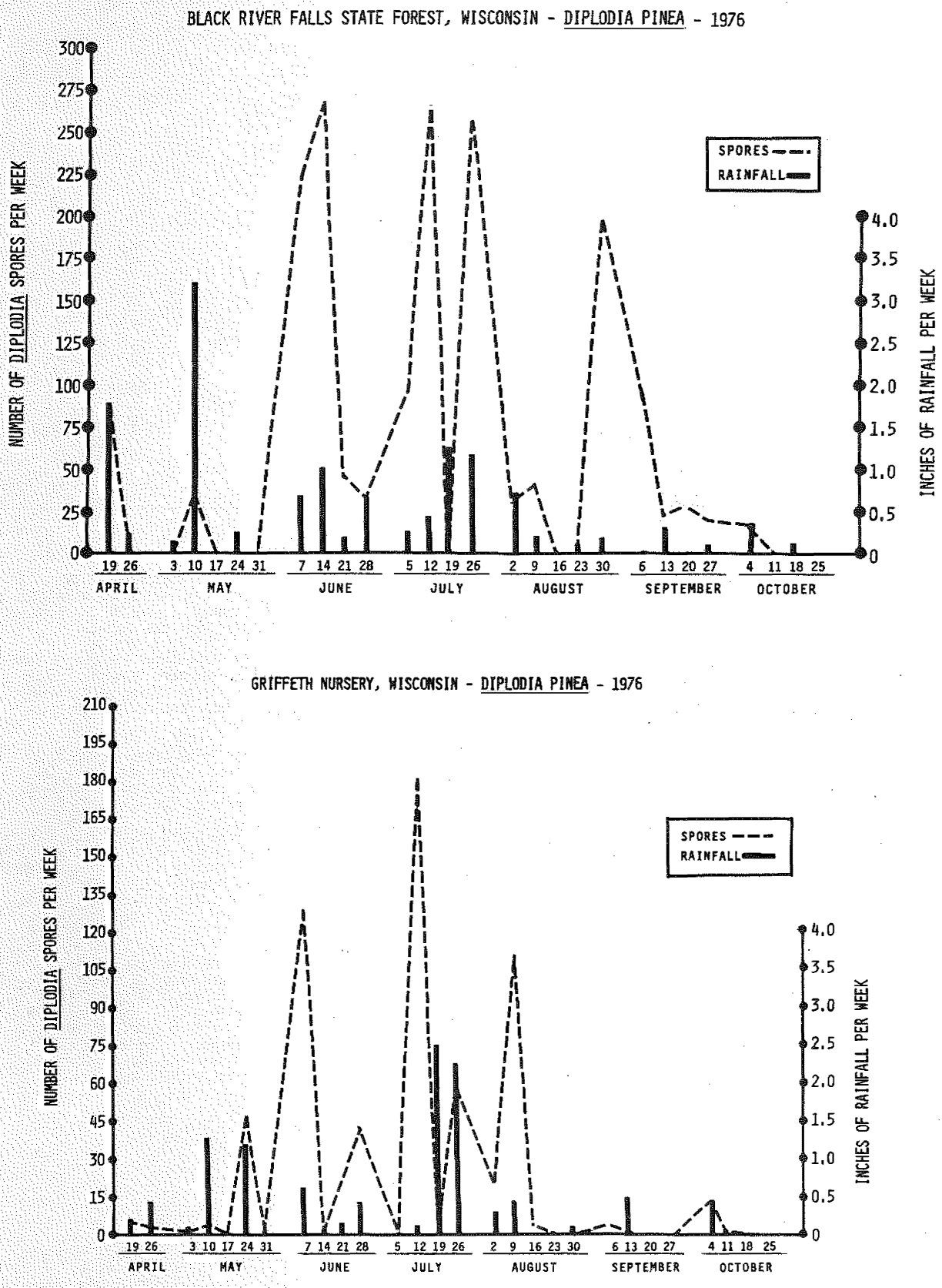


Figure 5. Diplodia pinea spore trapping at two study sites - 1976.

TABLE 1. *Diplodia pinea* spore counts at three study sites in 1976.

Study area and Host	Spore trapping period	Spore trap	Spore trap location	Total spore count	Total rainfall (inches)
Black River State Forest, Black River Falls, Wis., (on jack pine)	April 19 to October 25, 1976	A	Under infected tree	503	13.14
		B	Under infected tree	111	
		C	Under infected tree	1,113	
		D	In open, 12 feet from nearest infected tree	3	
			Total	1,751	
Griffith Nursery, Wisconsin Rapids, Wis., (on red pine)	April 19 to October 25, 1976	A	Surrounded by infected seedlings	16	11.12
		B	Red pine windbreak	10[a]	
		C	Red pine windbreak	2[a]	
		D	In nursery bed	3	
		E	In forest, ½-mile from nursery	549	
		F	In forest, ½-mile from nursery	71	
			Total	651	
Hayward Nursery, Hayward, Wis., (on red pine)	May 21 to September 7, 1976	A	Red pine windbreak	0	--
		B	Red pine windbreak	0	
		C	Red pine windbreak	0	
			Total	0	

[a]Nursery workers inadvertently cut infected red pine in windbreaks on May 24, 1976.

Butternut Canker & Dieback - An unnamed fungus coded BN-5

Widespread dying of Butternut (*Juglans cinerea* L.) was first reported in southwestern Wisconsin in 1967. An initial examination of the dieback in 1967 indicated that *Melanconium oblongum* Beck. was associated with the dieback. However, cankers were present and Graves' description of the Melanconis disease in Connecticut in 1923 specifically mentioned that no well-marked lesion or canker was associated with the disease.

Symptoms of the dieback and canker in southwestern Wisconsin include ellipically-shaped stem and branch cankers that occur under the bark, with black ooze apparent on the bark surface. Peeling the bark from the trunks is often necessary to locate the cankers. Adventitious bud scars are often present in the center of the canker. Individual cankers can girdle branches and cause wilting of branches. Multiple stem cankers that coalesce cause major crown dieback and sprouts develop just below the girdled portion.

In 1969 studies were initiated on the cause of butternut canker dieback in Wisconsin by James E. Kuntz, Department of Plant Pathology, University of Wisconsin-Madison. Dr. Kuntz isolated an unnamed fungus that was capable of inciting typical cankers on young butternut saplings in the field as well as small seedlings in the greenhouse. The fungus in the process of being identified has the code name BN-5.

A Pest Alert concerning "butternut decline" was issued in 1976 by Northeastern Area State and Private Forestry - Forest Service, USDA. This alert resulted in reports of the canker being found throughout the range of butternut in the United States except for New Hampshire and Vermont. So far the canker-inciting fungus (BN-5) has been isolated from diseased butternut specimens collected in Iowa, Michigan, Minnesota, Missouri and Wisconsin. Because butternut canker was first reported in Wisconsin and numerous trees were dying from the disease in the southwestern part of the state, a survey was initiated in 1976 to determine the distribution and impact of the disease in Wisconsin.

In Wisconsin an intensive survey was initiated to determine the distribution and impact of the disease. Plots from Wisconsin's 1968 Forest Survey (4) were used to locate areas in the state where butternut was present. A computer sort was made for all plots that had butternut present. A maximum of 5 one-fifth-acre plots per county were selected and examined by Forest Service and DNR field crews in 1976. Where possible, a maximum of 50 butternut trees were examined on or adjacent to each plot. Data were recorded on tree health, canker presence, limb or top dieback, death due to cankering or other causes. Trees were also grouped into poletimber (<10" d.b.h.) and sawtimber (>10" d.b.h.) classes. Dying branches or cankers were collected from each plot and isolations made in the laboratory on acidified potato dextrose agar for possible known or unknown pathogenic fungi.

A total of 2,882 butternut trees were examined on or adjacent to 83 plots. Cankers were present on 30.9% of all trees examined and 8.7% of all trees were dead (Table 2). Cankering and mortality were most severe in southwestern Wisconsin. Mortality was lowest in northeastern Wisconsin where the trees had the best form, few dead lateral branches or top dieback. *Melanconium oblongum* was found on dead branches throughout the range of butternut in Wisconsin. The canker inciting fungus (BN-5) was isolated from cankers collected in the western half of the state. However, it was not isolated from cankered or healthy trees in the eastern half of the state (Figure 6).

TABLE 2. Butternut canker and tree mortality - Wisconsin, 1976.

Tree Class*	Trees (No.)	(%)	Trunk Canker No.	(%)	Branch Dieback No.	(%)	Mortality No.	(%)	Healthy No.	(%)
Poles (10" dbh)	1781	61.8	614	34.5	617	34.7	172	9.7	850	47.7
Sawtimber (10" dbh)	1101	38.2	276	25.0	597	54.2	80	7.3	521	47.3
Total (Poles & Sawtimber)	2882	100.	890	30.9	1214	42.1	252	8.7	1271	44.0

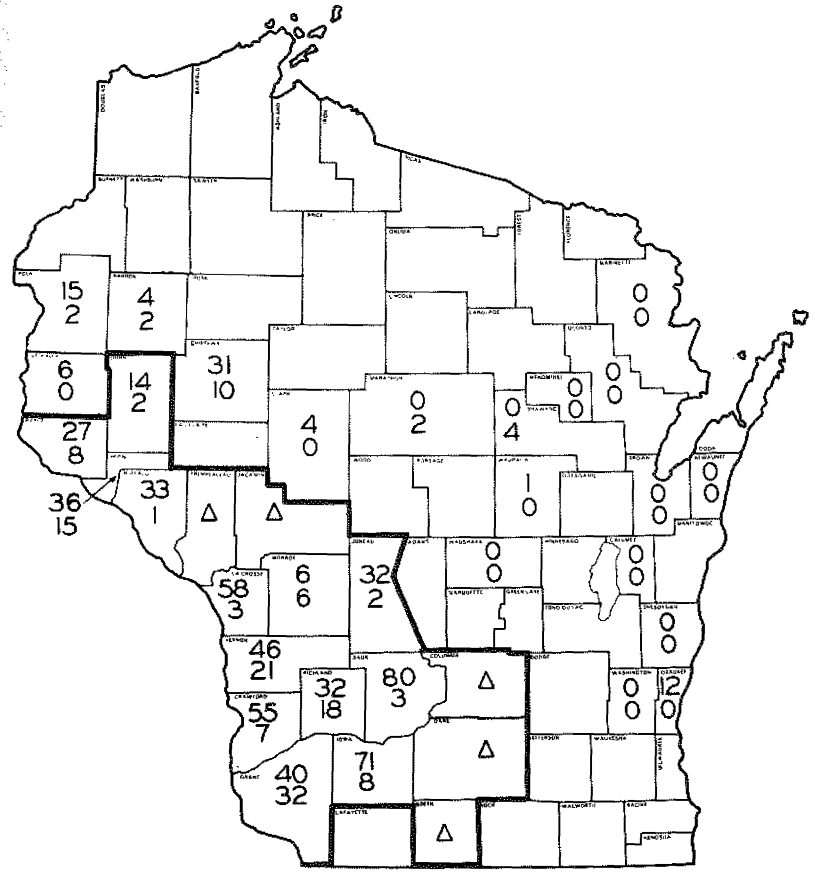


Figure 6. Butternut Canker Survey - Wisconsin 1976.

Red Pine Shoot Blight - *Sirococcus strobilinus* Preuss
There was no change in the state-wide distribution of red pine shoot blight in Wisconsin (Figure 7). However, disease incidence did increase in previously recorded areas within the Northern Highland State Forest in Vilas County. A shoot blight impact plot established by DNR Forest Pest Management personnel at Starrett Lake showed an 8% increase in tree mortality in 1976. No trees died in openings but after five years 63% of the trees were dead in the understory (Table 3).

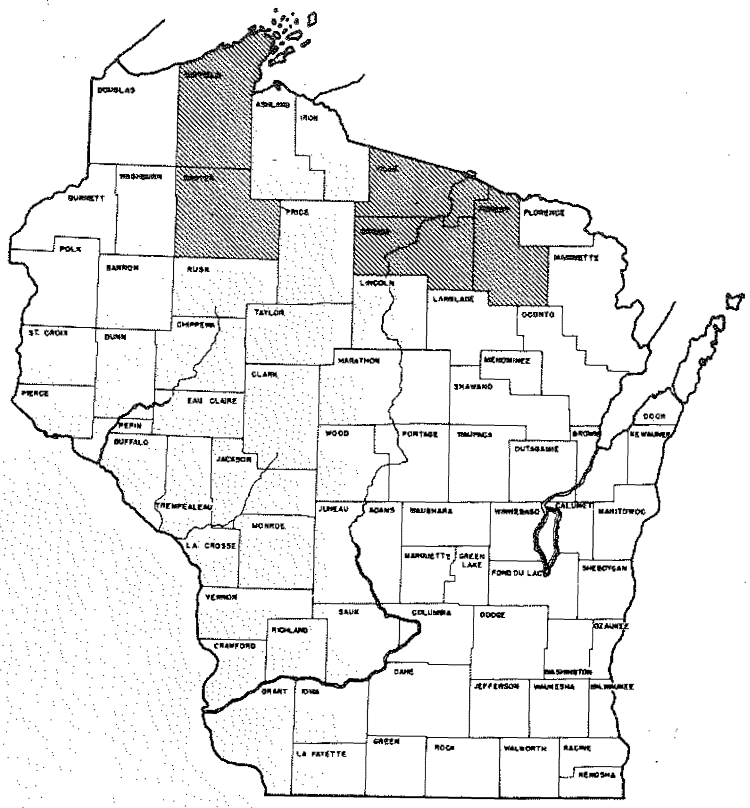


Figure 7. Known County Distribution of Red Pine Shoot Blight - 1976.

Table 3. Cumulative Tree Mortality[1/] Starrett Lake Red Pine Shoot Blight Plot, Northern Highland State Forest, Vilas County, Wisconsin (Sec. 24, T41N, R7E).

Year	Openings (%)	Understory (%)
1972	0	20
1973	0	31
1974	0	45
1975	0	59
1976	0	63

[1/]Plot totals: number of trees in openings - 49
number of trees in understory - 51

The Wisconsin DNR continued to cooperate with the North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minnesota, in an ecological and silvicultural control study of red pine shoot blight on the Northern Highland State Forest. Removal of infected overstory trees in 1975 was utilized as a silvicultural control measure. Examination of the plots on October 21, 1976 indicated that removing infected overstory trees may be effective in preventing new infections in remaining understory trees (Table 4). This was confirmed by similar studies on the Nicolet National Forest.

A meeting concerning shoot blight control methods was held on the Nicolet National Forest on August 3, 1976. Department of Natural Resources personnel met with U.S. Forest Service representatives from the Nicolet National Forest, North Central Forest Experiment Station, and State and Private Forestry to discuss controls developed by the North Central Forest Experiment Station. The decision was made that the control procedures should be directly implemented as recommended control practices without the customary pilot control testing, following final readings on the silvicultural control plots in 1976. Silvicultural controls were developed in the fall of 1976 and updated and published in 1978 (Appendix B).

Table 4. *Sirococcus*-infected red pine removal study, Northern Highland State Forest, Wisconsin.

Plot numbers	Treatment	Total number infected overstory trees removed*	Total number infected understory trees removed*	Total cutting time**	Number new infections as of 10-21-75	Number new infections as of 10-21-76
1 & 4	All infected trees removed	2	228	85 min.	0	1
2 & 5	Left infected overstory--removed infected understory	0	69	15 min.	4	11
3 & 6	Infected overstory and understory No treatment	0	0	--	7	10
7 & 8	Healthy overstory and understory No treatment	0	0	--	0	5
9 & 10	Healthy trees in open No treatment	0	0	--	0	0

*Removed on 5-21-75.
**One man using a chain saw.

ROOT ROTS

Shoestring Root Rot - *Armillaria mellea* (Nalex Fr.) Kummer
Some red pine mortality is still continuing in plantations in northwest Wisconsin where release work was done. The drought appears to have intensified this mortality. One plantation in Sec. 18, T42N, R13W, Washburn County has lost up to 40% of the trees and mortality is still continuing. This was planted in a fairly dense stand of scrub oak which was herbicided about four years ago.

Damping Off and Root Rot - *Fusarium spp.*
Fusarium spp. was isolated from damped off white pine seedlings at Wilson State Nursery, Boscobel and Griffith State Nursery, Wisconsin Rapids. The fungus was also isolated from damped-off red pine seedlings at Hayward State Nursery. White pine seedlings infected in 1975 at Wilson continued to die in 1976. Approximately 67% of the original inventory of white pine 1-0 at Boscobel died in 1975-76. The 1975 inventory of white pine 1-0 was 1,140,000. In August, 1976, the inventory of 2-0 white pine was 388,000 live trees.

Black Walnut Root Rot - *Cylindrocladium spp.*
Root rot in unfumigated walnut seedling beds at Wilson State Nursery resulted in a loss of 75,000 seedlings. Root rot was observed when seedlings were being lifted for field planting in April, 1976. The causal organism was determined to be *Cylindrocladium spp.* Walnut seedlings grown in adjacent beds fumigated with Mylone were healthy.

FOLIAGE DISEASES

Poplar Leaf Rust - *Melampsora medusae* Thum.
The DNR Forest Pest Control Unit participated in an epidemiological study of *Melampsora medusae* leaf rust of poplars in cooperation with the North Central Forest Experiment Station. Petrolatum coated microscopic slides were placed in wire holders under poplar trees in Madison and Rhinelander, Wisconsin, and changed weekly from April-October, 1976. Other states participating in the study were Minnesota, Iowa, Missouri, Illinois, Arkansas, Mississippi and Louisiana. Information gathered from this study will be published as a research paper by the North Central Forest Experiment Station.

MISCELLANEOUS

Drought
Monthly precipitation deficits began in the Northwest and North Central climatic divisions in April and in the rest of the state in May. The annual deficits (average within climatic divisions) ranged from 4.35 inches in the Southeast to 12.99 in the Northwest. In the western parts of the state, annual deficits of 40 or more percent below normal were common.

Many new pine and hardwood plantings suffered heavy mortality. Some pine plantings on dry sandy soils, and where weeds were not controlled, were completely killed.

Drought-related bark beetle infestations occurred all over the state; they were most severe in the Northwest District.

Populations of late summer defoliating insects were hard hit by the drought. By mid-July the foliage on some species, particularly the oaks, was dry and leathery. Presumably the young larvae were unable to establish under these hot dry conditions. Lack of defoliators was particularly evident to entomologists collecting larvae for the parasite survey.

Ice Storm
A major ice storm during the period of March 1-5 resulted in widespread destruction of trees, power lines and other property across southern Wisconsin. Ice accumulations up to five inches thick occurred in many areas. High winds following the ice buildup resulted in partial to total destruction of tree crowns in many areas.

Twenty-two counties were declared disaster areas (Figure 8). Within this region, the heaviest ice buildup occurred in a central area that included parts of sixteen counties. This area was determined by the Nursery Inspection staff of the Wisconsin Department of Agriculture.

Damage in the forest ranged from a few broken limbs to entire crowns destroyed and trees permanently bent over and uprooted. Pole-sized pine plantations were especially hard hit; the wind-ice combination produced a domino effect which knocked trees down in tear-drop shaped patches in the Kettle Moraine State Forest.

Tree species generally hardest hit were elm, black cherry, aspen, ash, red maple and silver maple. Oaks generally fared better; however, those with wide spreading limbs and internal decay were often heavily damaged. Some oaks broke off at the ground - victims of butt rot.

The area near Blue Mounds and Mt. Horeb in western Dane County was especially hard hit. High hilltop elevations produced especially heavy ice buildup. Within Blue Mounds State Park, many large oak crowns were completely split apart. Young oak 6-10 inches were bent over until their tops rested on the ground.

The most serious long term effect will probably be heavy incidence of internal decay. Buildup of large wood borer populations is also possible.

PUBLICATIONS

Benjamin, Daniel M. and Donald W. Renlund. 1976. Insecticide use in Wisconsin natural forests and plantations 1969-1976. Univ. Wis. For. Res. Note 198.

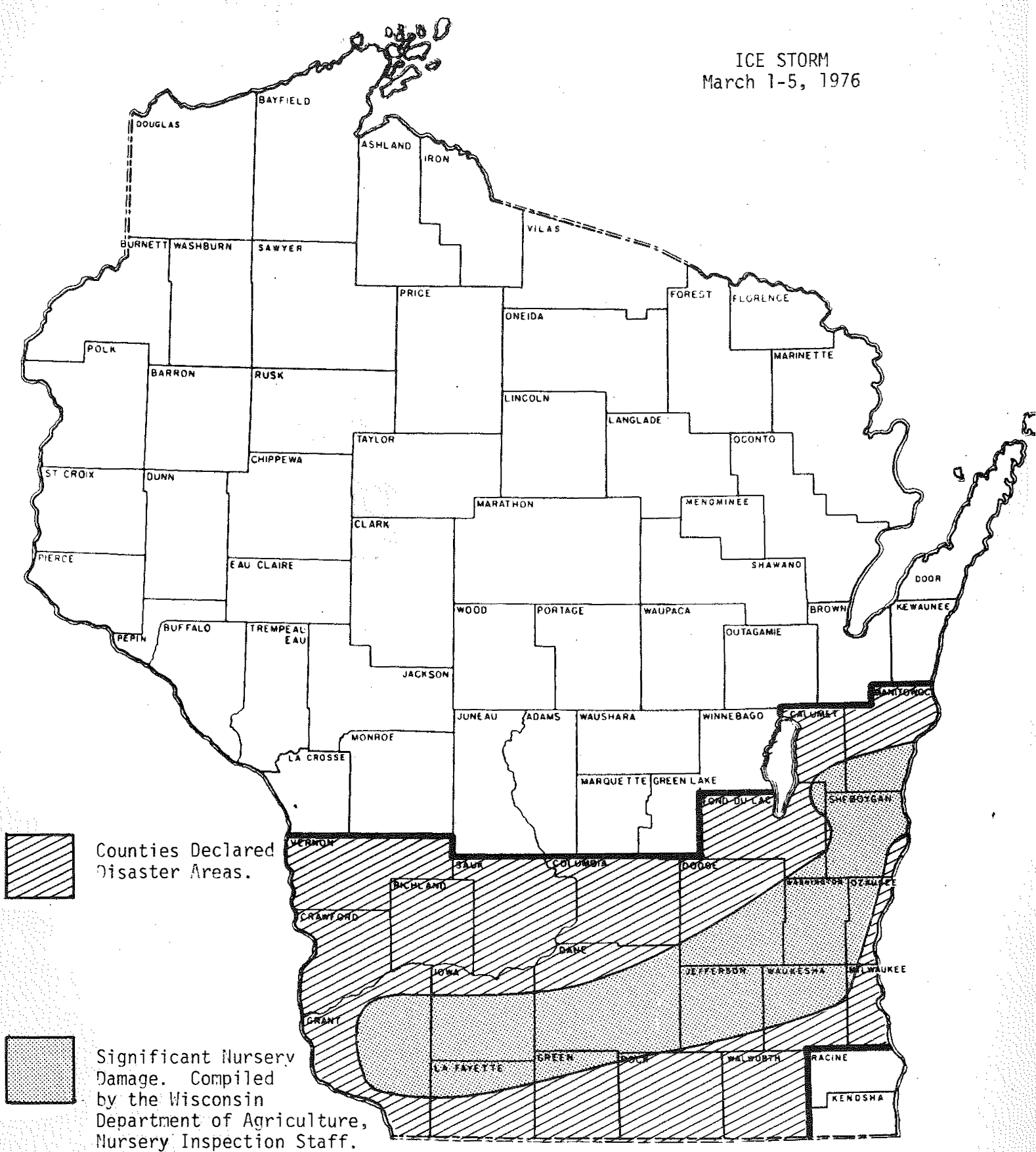


Figure 8. Ice storm damage March 1-5, 1976.

APPENDIX A

Biological Control Program
by
David Hall

I. Parasite Survey

A. Collections - Weekly collections of immatures were made at all seven permanent monitoring locations. By mid-summer, larvae were extremely difficult to find on the foliage presumably because they were unable to feed on the dry foliage. Only about 4100 immatures were collected, down from about 5000 in 1975.

Malaise traps were placed at all seven collection sites. More than eighty pints of specimens were collected and delivered to the insectarium at the University of Wisconsin-Madison, Department of Entomology.

B. Larval Identification - Substantial progress was made in identification of microlepidoptera through keying as well as association with reared adults. The larval reference collection now stands at over 600 specimens; more than 200 are named to genus or species.

C. Rearing - Slight modification of handling procedures increased efficiency of feeding. About 500 adult Lepidoptera and thousands of parasites were reared and sent to the U.W. insectarium. Several hundred immatures were given a conditioning cold treatment and then were incubated in the lab.

D. Adult Identification - Many lepidopterous species not previously reared in the parasite survey have been identified. A preliminary list of reared Lepidoptera and host plants is being prepared for publication.

A total of about 10,000 specimens of parasitic hymenoptera have been mounted from reared and malaise trap material. Dr. Roy D. Shenefelt identified many genera of Braconid parasites new to Wisconsin.

II. Parasite Releases

A. *Compsilura concinnata* - One thousand were released in Wyalusing State Park (Sec. 19, T6N, R6W) May 28, 1976. This parasite will attack many lepidopterous species.

B. *Brachymeria intermedia* - Eleven thousand were released in Oneida County (NESW, Sec. 9, T35N, R11E) on June 17, 1976. Intended hosts are spruce budworm and large aspen tortrix.

APPENDIX B

Silvicultural Controls for *Sirococcus* Shoot Blight of Red Pine

by
Thomas H. Nicholls[1/]

1. Before controls for *Sirococcus strobilinus* are attempted, be sure a positive identification of the disease is made. Train workers to be alert for and to recognize *Sirococcus*. Early disease detection and control can often prevent serious losses. In Michigan, Minnesota, and Wisconsin the disease has not been found south of 45° N Latitude.

2. Do not plant red pine seedlings under infected trees. If planted adjacent to infected trees, a minimum buffer zone should be no less than twice the height of infected trees. The buffer zones may be left vacant and used for wildlife openings or, as another alternative, may be managed for immune species (species which cannot be infected by *Sirococcus*, see Item 4). In planting areas where *Sirococcus* is present and it is impractical to remove infected trees, red pine seedlings must be planted in the open where they will not be shaded by overstory trees. Shade and the higher moisture conditions that result from shading are favorable for infection. As an added precaution, newly planted red pine trees near older infected trees should be periodically checked to make sure the disease has not spread into the new plantation. If infection is found, carry out pertinent control procedures as outlined in Item 3.

3. Where there are pockets of infected overstory and understory trees in an otherwise healthy plantation, the infected trees should be cut or girdled. Otherwise, they serve as an inoculum source to infect nearby trees. If the understory trees are small enough, the trees can be saved by clipping off and destroying the infected shoots. Even without clipping, many trees will recover if infected overstory trees are removed and remaining trees are not shaded.

4. In high *Sirococcus* hazard areas manage for immune species. These include all deciduous species; white, black, and Norway spruce; white, Austrian, and Scotch pine; and balsam fir. Before choosing an alternate species for planting, be sure other important diseases or insects of the chosen species are not prevalent in the area.

5. To avoid microclimatic conditions favorable for infection and potential inoculum sources, do not leave individual or groups of large red pine during logging operations in areas where *Sirococcus* is epidemic or where serious outbreaks have occurred. This would only be important if the site was to be replanted with red pine or some other susceptible species.

6. If *Sirococcus* is present in the area, avoid humid, shady planting sites for red pine.

[1/] Plant Pathologist, North Central Forest Experiment Station, USDA Forest Service, 1992 Folwell Avenue, St. Paul, MN 55108.

APPENDIX C

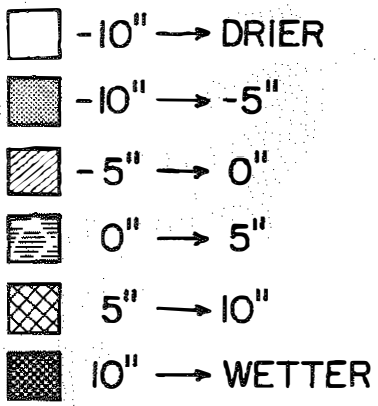
Wisconsin Precipitation 1960-1976 Departure from Normal

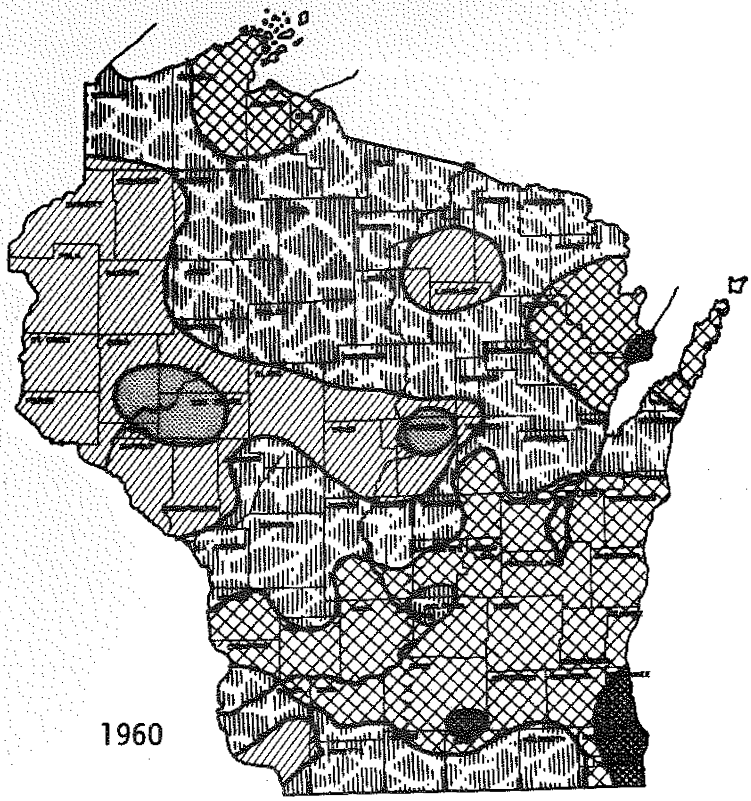
by
Jane E. (Peronto) Zarnstorff[1/]

This project was done during the fall semester of 1976 as part of a University of Wisconsin internship at the Department of Natural Resources, Forest Pest Control Laboratory, Madison, Wisconsin. The precipitation data were obtained from annual weather summaries[2/] on file in the pest control laboratory. Only data from stations listing a thirty year normal (1941 through 1970) were used. Departures from normal were divided into six categories. Lines of equal departure were hand drawn on state maps and the various categories were shaded accordingly.[3/]

1/ Student intern; Department of Forestry, University of Wisconsin-Madison.
2/ U.S. Department of Commerce, NOAA, Environmental Data Service, Wisconsin Annual Summaries Vols. 65-81.
3/ Maps by Richard G. Burton, Bureau of Research, Wisconsin Department of Natural Resources, Madison. Adapted from color originals by Jane (Peronto) Zarnstorff.

WISCONSIN PRECIPITATION
1960-1976
DEPARTURE FROM NORMAL





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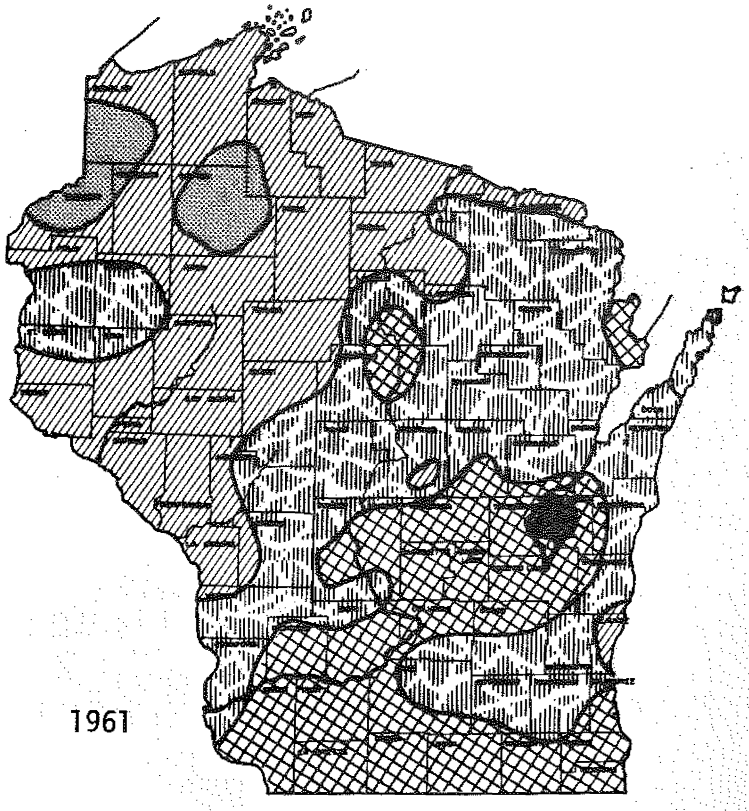

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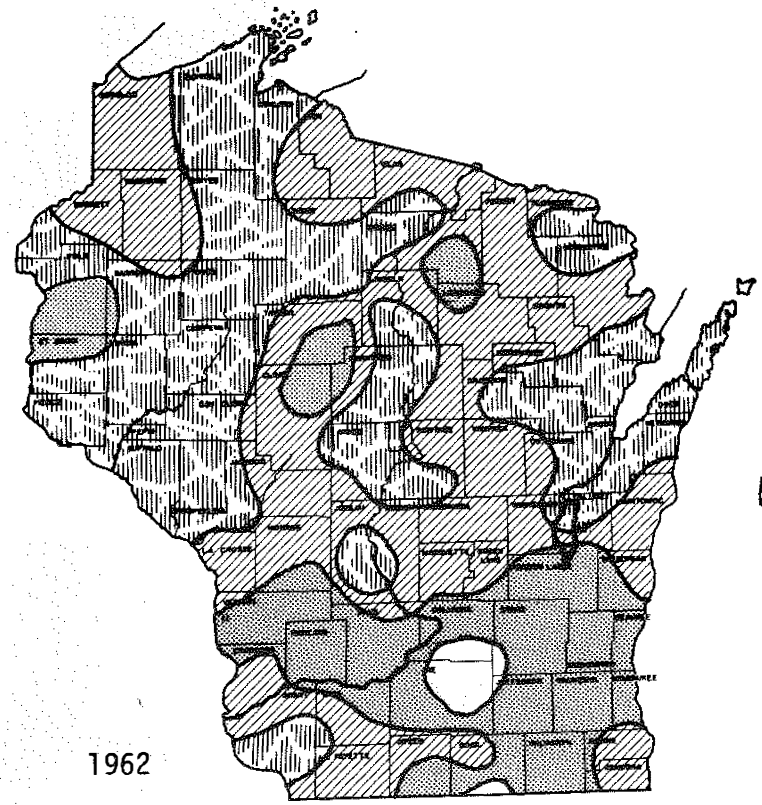

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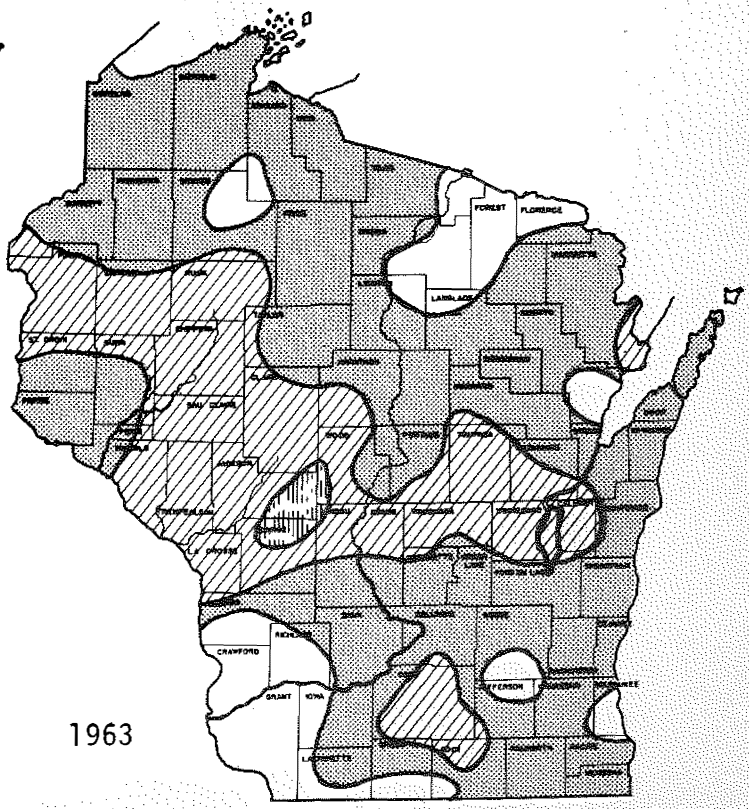

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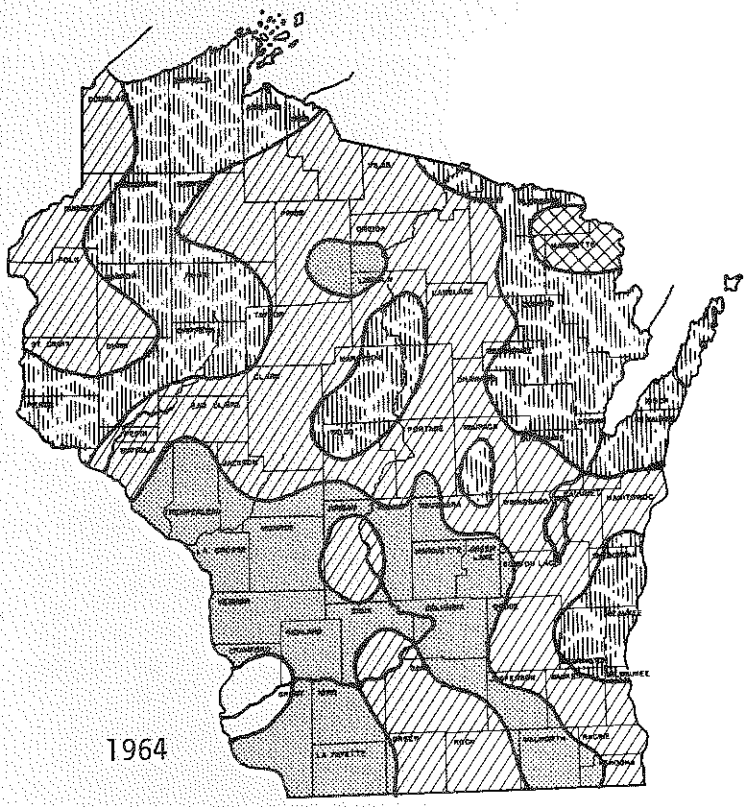

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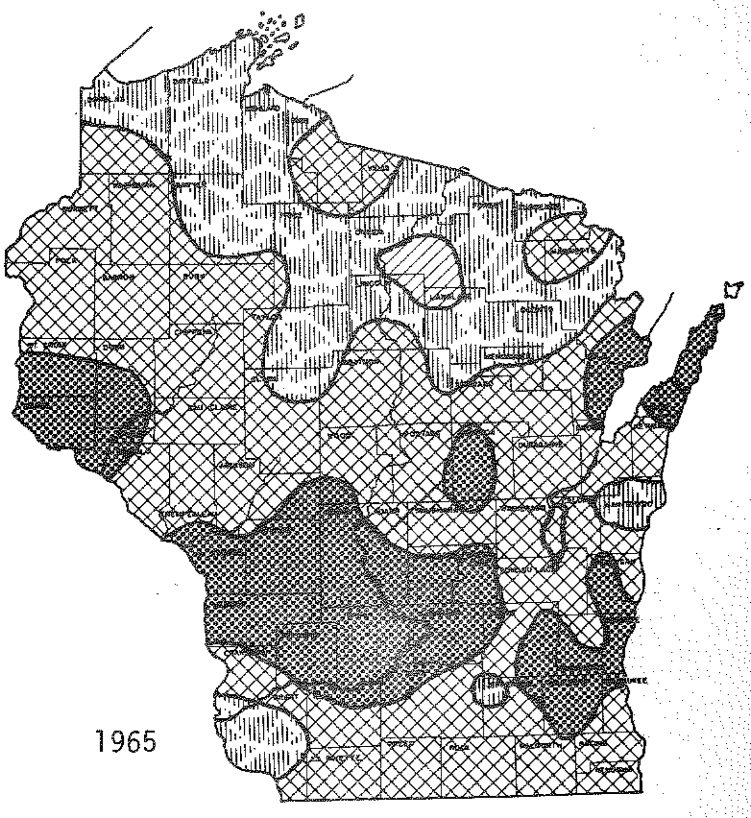

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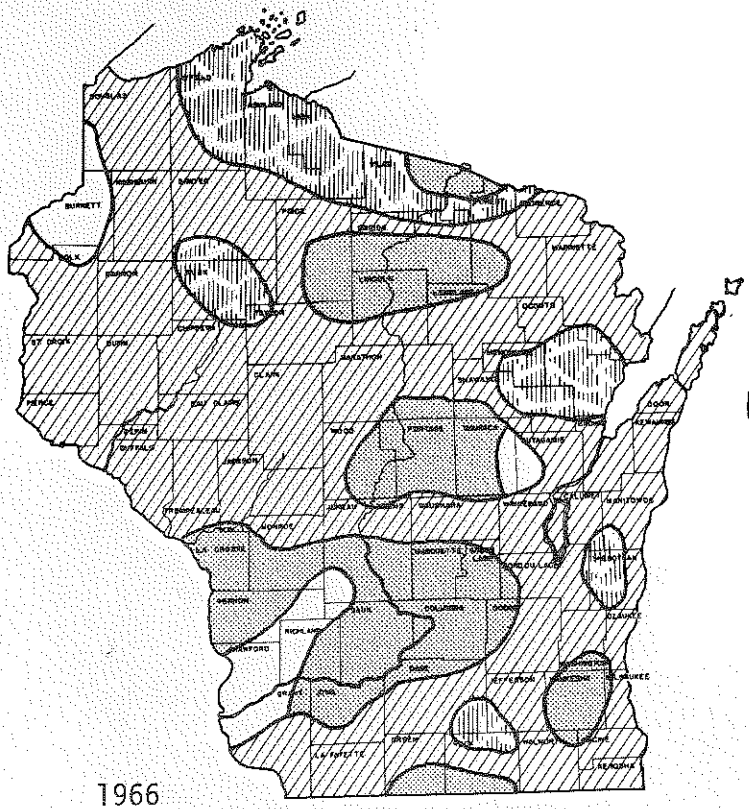

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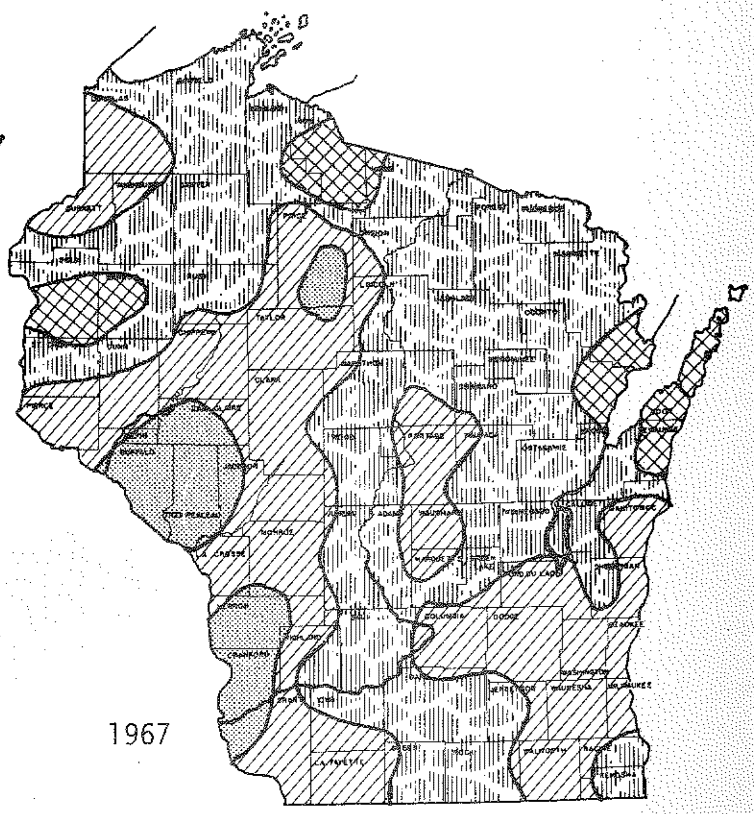

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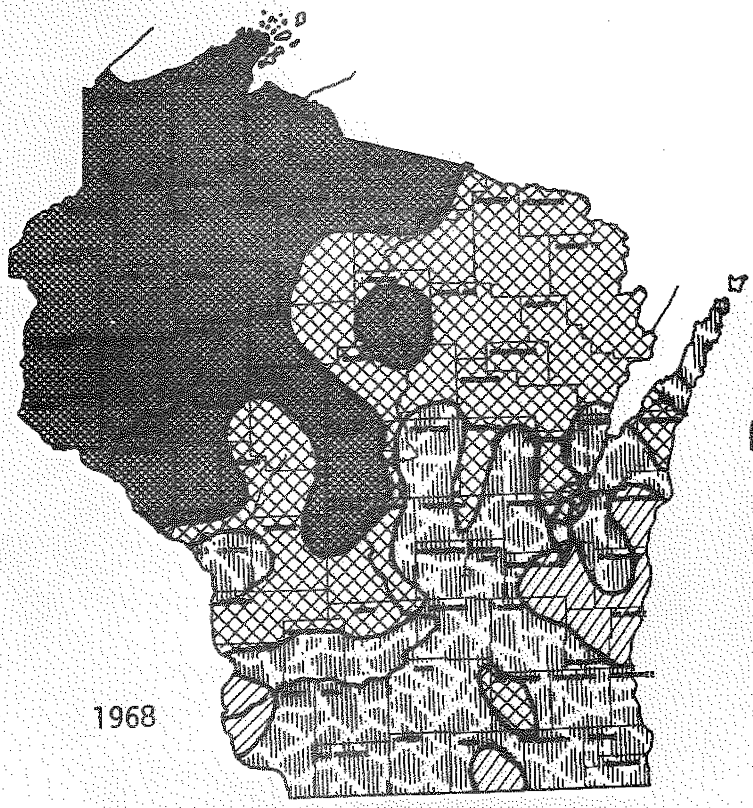

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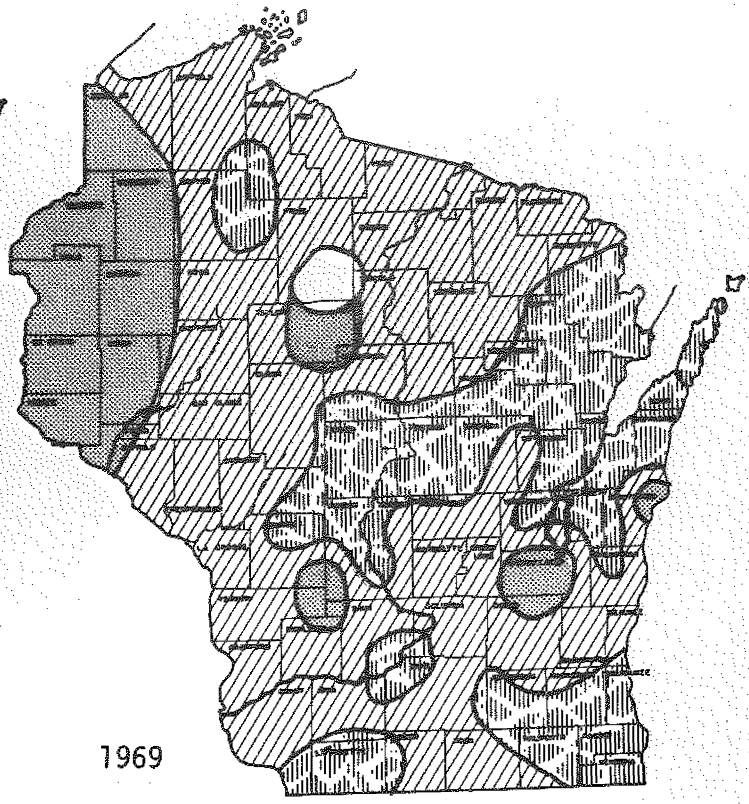

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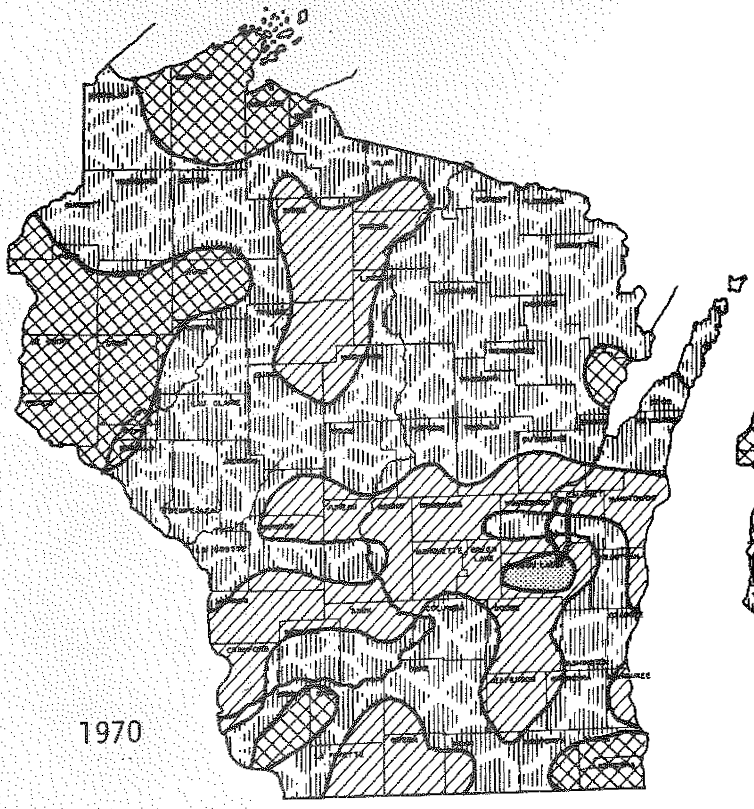

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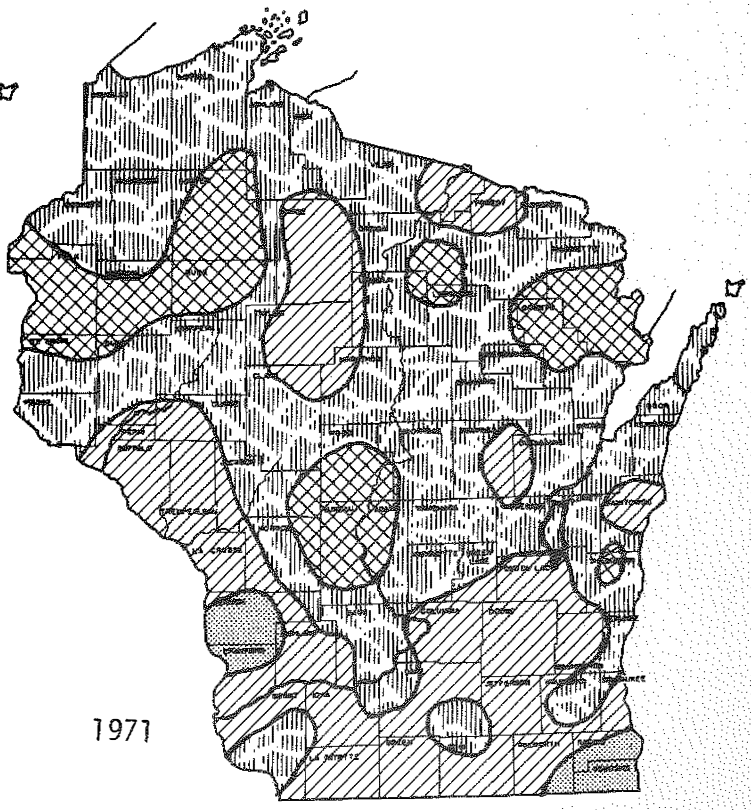

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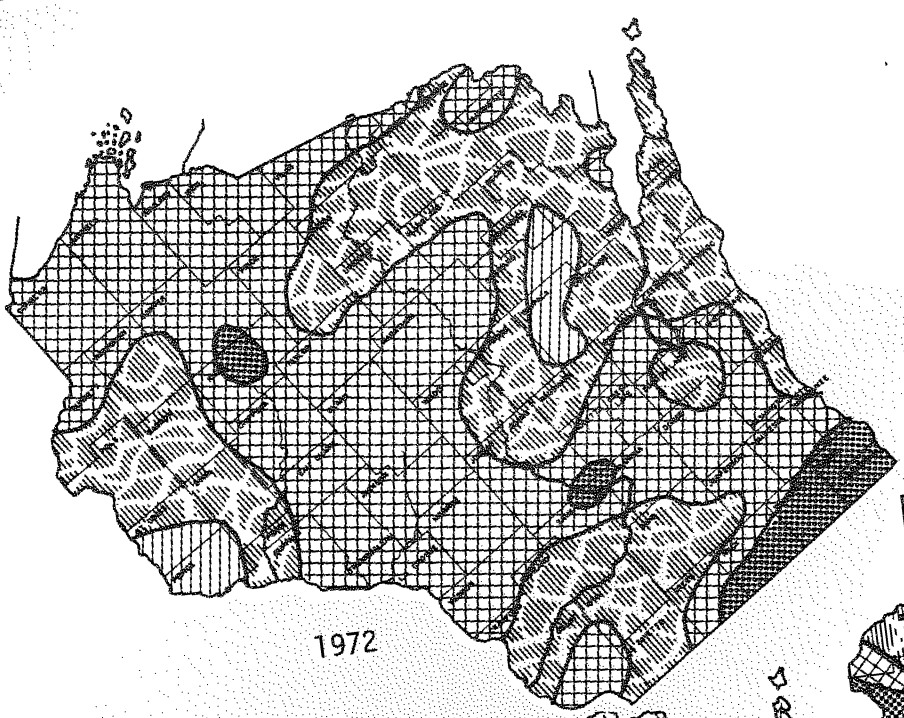

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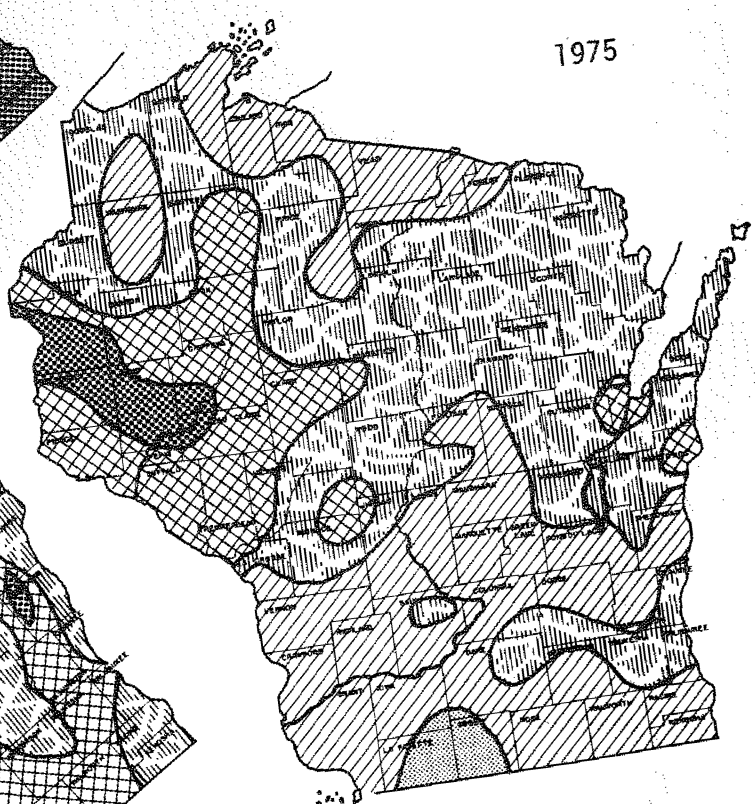
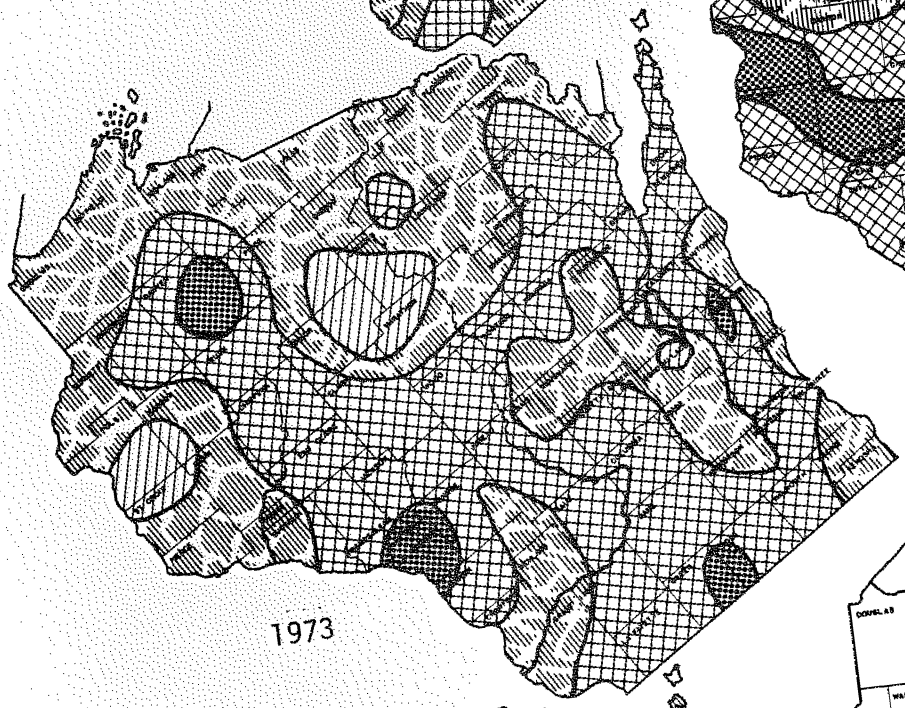
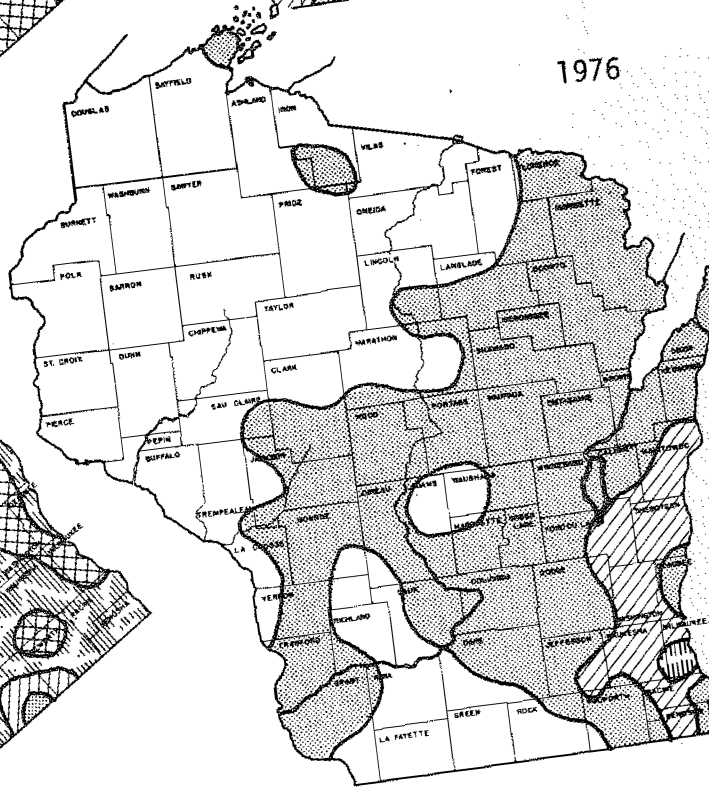


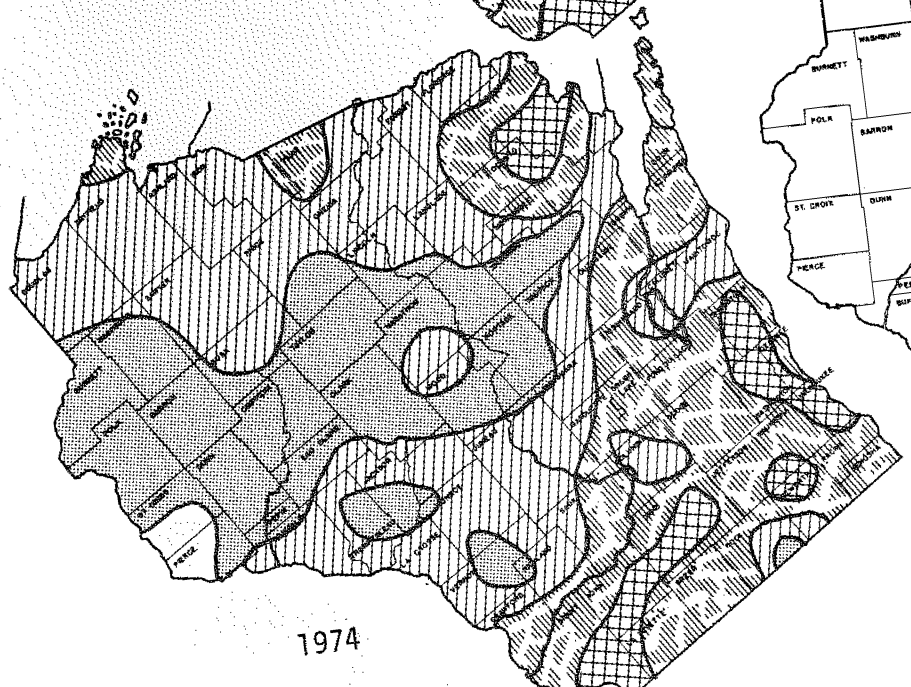
1975



1973



1976



1974